

Docket No. 511.40998X00  
Appl. No. 10/018,188  
December 15, 2005

### REMARKS

Applicants are amending their claims in order to further clarify the definition of various aspects of the present invention. Specifically, Applicants have amended claims 1 and 12 to recite that the CMP abrasive, or additive for a CMP abrasive, consists essentially of the specified components.

Moreover, Applicants are adding new claims 23-26 to the application. Claims 23 and 24 recite respectively a CMP abrasive and an additive for a CMP abrasive, each reciting an organic polymer having an atom or a structure capable of forming a hydrogen bond with a hydroxyl group present on a surface of a film to be polished, and water, claim 23 reciting additionally that the abrasive includes cerium oxide particles and a dispersant. Each of claims 23 and 24 also recite that a composition which is an aqueous slurry useful for the chemical-mechanical polishing of substrates which contain a metal and an insulator, comprising water, submicron abrasive particles, an oxidant and an organic polymer which attenuates removal of an oxide film, with the organic polymer having a degree of polymerization of at least 3 and having a plurality of moieties having affinity to surface groups contained on silicon dioxide surfaces, is excluded from the respective abrasive and additive.

Claims 25 and 26 respectively recite a CMP abrasive and an additive for a CMP abrasive, each reciting an organic polymer having an atom or a structure capable of forming a hydrogen bond with a hydroxyl group present on a surface of a film to be polished, and water, with claim 25 additionally reciting that the abrasive includes cerium oxide particles and a dispersant. Each of claims 25 and 26 recites that a metal film is excluded from the film to be polished.

Applicants respectfully submit that all of the claims presented for consideration by the Examiner on the merits in the above-identified application,

Docket No. 511.40998X00  
Appln. No. 10/018,188  
December 15, 2005

patentably distinguish over the teachings of the reference applied by the Examiner in rejecting claims in the Office Action mailed June 15, 2005, that is, the teachings of U.S. Patent Application Publication No. US2003/0181046 to Sachan, et al., under the provisions of 35 USC 102 and 35 USC 103.

It is respectfully submitted that the reference as applied by the Examiner would have neither taught nor would have suggested such a CMP abrasive as in the present claims, "consisting essentially of" the specified components recited in claim 1.

It is also respectfully submitted that the applied reference would have neither taught nor would have suggested the additive for a CMP abrasive as in the present claims, "consisting essentially of" the specified components recited in claim 12.

Furthermore, it is respectfully submitted that the applied reference would have neither taught nor would have suggested such CMP abrasive or such additive for a CMP abrasive as in the present claims, including, inter alia, the organic polymer having an atom or a structure capable of forming a hydrogen bond with a hydroxyl group present on a surface of a film to be polished, provided that a metal film is excluded from the film to be polished (see claims 25 and 26).

Moreover, it is respectfully submitted that the applied reference would have neither taught nor would have suggested such a CMP abrasive, or such additive for a CMP abrasive, as in the present claims, having the specified components, and provided that the composition which is an aqueous slurry useful for the chemical-mechanical polishing of substrates which contain a metal and an insulator, having components as set forth in claims 23 and 24, is excluded.

Furthermore, it is respectfully submitted that the applied reference would have neither disclosed nor would have suggested such CMP abrasive, or such additive, as

Docket No. 511.40998X00  
Appln. No. 10/018,188  
December 15, 2005

in the present claims, and particularly wherein the film to be polished is an inorganic insulating film (see claims 16 and 20), in particular is at least one of a silicon oxide film and a silicon nitride film (see claims 17 and 21); and/or the further definition of the organic polymer as in claims 2-5, 7, 8, 15 and 22; and/or amount of organic polymer included in the abrasive, as in claims 13 and 14 (note also claim 9, reciting amounts of organic polymer and other components); and/or sedimentation speed of the cerium oxide particles in the abrasive, as in claim 6.

The invention as being considered on the merits in the above-identified application relates to a CMP abrasive used in a step for smoothing a surface of a substrate, particularly for smoothing an insulating film (e.g., an interlayer insulating film), and to an additive for providing the CMP abrasive.

With current ultra-large scale integrated circuits, having increased packaging density, CMP technology has become more important for fully smoothing (e.g., planarizing) a layer, especially for planarizing an interlayer insulating film and a BPSG (Boron Phosphorus-doped Silicon Dioxide) film and performing shallow trench isolation. With conventional CMP technology for smoothing an interlayer insulating film, technical problems arise in that a high-level of smoothing can not be realized over an entire surface of a wafer, as described on the first paragraph on page 2 of Applicants' Specification.

Against this background, Applicants provide a CMP abrasive, as well as additives therefor, capable of polishing a surface to be polished (in particular, an insulating film, such as a silicon oxide or silicon nitride insulating film) at high speed, without causing scratches, while achieving a high level of smoothing. Applicants have achieved these objectives with a CMP abrasive according to the present invention, which also has excellent storage stability. Applicants have found that by

Docket No. 511.40998X00  
Appln. No. 10/018,188  
December 15, 2005

including an organic polymer having an atom or a structure capable of forming a hydrogen bond with a hydroxyl group present on a surface of a film to be polished, in a polishing material also consisting essentially of, e.g., the dispersant and cerium oxide particles, and water, objectives according to the present invention are achieved. That is, a surface to be polished (in particular, an insulating film such as a silicon oxide film or silicon nitride film) can be polished with a high speed and a high level of smoothness, without scratches, achieving a manufactured product, using the polishing, in a high yield. In addition, the CMP abrasive according to the present invention has good storage stability. Note from page 24, line 31 to page 25, line 12, of Applicants' Specification.

Illustrative of the advantages achieved according to the present invention, attention is respectfully directed to the Examples and Comparative Examples on pages 13-24 of Applicants' Specification. As can be seen in the polishing speed ratios  $R_5/R_1$  and  $R_3/R_1$  in the Examples and Comparative Examples in the present Specification, these ratios were much closer to one for compositions according to the present invention (note Examples 1 and 2 on pages 13-21 of Applicants' Specification), as compared with polishing speed ratios for Comparative Examples 1 and 2 on pages 21-24 of Applicants' Specification. In particular, compare the polishing speed ratios for Examples 1 and 2, respectively set forth at page 18, lines 13-23 and page 20, line 26 to page 21, line 11; with the polishing speed ratios for Comparative Examples 1 and 2, respectively, at page 23, lines 7-20 and page 24, lines 13-20. As is clear from these Examples and Comparative Examples, unexpectedly better smoothing at higher polishing speeds, corresponding to the polishing speed ratios closer to 1, are achieved according to the present invention, including the organic polymer recited in the present claims, as compared with the

Docket No. 511.40998X00  
Appln. No. 10/018,188  
December 15, 2005

Comparative Examples. It is respectfully submitted that this evidence of unexpectedly better results must be considered in determining patentability of the present invention (see In re DeBlauwe, 222 USPQ 191 (CAFC 1984)); and, properly considered, it is respectfully submitted that this evidence of unexpectedly better results clearly supports a conclusion of unobviousness of the presently claimed subject matter.

Sachan, et al. discloses techniques for polishing and planarization of integrated circuit surfaces, particularly those comprising a metal, a barrier layer and an insulating layer. This patent is primarily directed to such polishing which attenuates removal of the oxide film during metal CMP. This patent discloses that by including one or more organic polymers which attenuate removal of the oxide film, the polymers having functional moieties interacting strongly with the silicon oxide surface so as to provide a protective layer that inhibits removal of the silicon dioxide film at appreciable levels, the metal and barrier layer can be polished without removal of the oxide film. Note paragraphs [0003] and [0013] - [0017] on pages 1 and 2 of Sachan, et al. This patent document further discloses that the slurries may optionally contain a dispersant, which dispersant can be anionic, cationic or nonionic. See paragraph [0019] on page 2 of this published patent application.

Initially, it is emphasized that Sachan, et al. is primarily concerned with polishing a metal layer while attenuating removal of the oxide film. In this regard, note that Sachan, et al. includes, inter alia, an oxidant to oxidize the metal, as well as a metal complexing agent. In contrast, according to the present invention an oxide film may be polished. It is respectfully submitted that Sachan, et al. would have neither taught nor would have suggested such abrasive or such additive as in the present claims, consisting essentially of the recited components.

Docket No. 511.40998X00  
Appln. No. 10/018,188  
December 15, 2005

It is again emphasized that Sachan, et al. is primarily concerned with polishing a metal layer. It is respectfully submitted that this disclosure in Sachan, et al. would have neither taught nor would have suggested such abrasive or additive as in the present claims, including wherein a metal film is excluded from the film to be polished.

Furthermore, it is noted that claims 23 and 24 respectively recite a CMP abrasive and an additive for a CMP abrasive, excluding compositions in Sachan, et al. Based thereon, it is respectfully submitted that Sachan, et al. would have taught away from the presently claimed subject matter, as in claims 23 and 24.

The contention by the Examiner on page 3 of the Office Action mailed June 15, 2005, that the abrasive/additive of Sachan, et al. is capable of being used to polish the films recited, is respectfully traversed. It is emphasized that Sachan, et al. discloses that the composition therein attenuates removal of the oxide film. Accordingly, it is respectfully submitted that this reference especially would have taught away from polishing of the films as recited in claims 16, 17, 20 and 21.

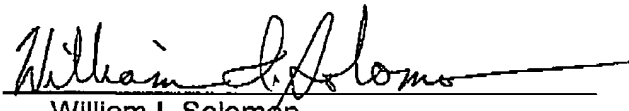
In view of the foregoing comments and amendments, reconsideration and allowance of all claims presently in the application are respectfully requested.

Docket No. 511.40998X00  
Appln. No. 10/018,188  
December 15, 2005

To the extent necessary, applicants petition for an extension of time under 37 CFR .136. Please charge any shortage in fees due in connection with the filing of this paper to the Deposit Account of Antonelli, Terry, Stout & Kraus, LLP, Dep. Account No. 01-2135 (case: 511.40998X00), and please credit any excess fees to such deposit account.

Respectfully submitted,

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